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USSR REPORT

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CONTENTS

GROUND FORCES

MOTORIZED RIFLE UNITS: TRAINING AND RELATED ACTIVITIES

MRU Flamethrower Mountain Exercise

Moscow KRASNAYA ZVEZDA in Russian 29 Jan 82 p 1

[Article by Lt Col A. Ryabkin, Red Banner Central Asian Military District: "Flamethrower Personnel in the Attack"]

[Text] Col Gen D. Yazov, commander of Red Banner Central Asian Military District, observed the practice combat in the mountains by the motorized rifle battalion commanded by Capt V. Kobylyanskiy. Originality of the concept and maximum approximation of the situation to conditions of real combat made the tactical exercise dynamic and interesting. The actions of initiative taken by flamethrower personnel who screened the motorized riflemen's attack with fire gave it a special coloration. Col Gen Yazov presented valuable gifts to flamethrower personnel who best distinguished themselves with high field schooling and expert use of equipment and weapons: Sr Lt A. Sereda, Sgt Zh. Amirtayev and Pvt I. Chebotar'.

Taking advantage of air strikes and supported by artillery fire, the motorized rifle battalion penetrated "enemy" defenses toward evening. The company commanded by Sr Lt O. Ivanov operated most successfully on the right flank.

The outcome of combat depended on who would be first to close the entrance to the canyon: the attackers or the "enemy." The strongpoint on a hill dominating the terrain could become a unique "fortress." But according to intelligence, the hill was girded from the front by trench lines and earth-and-timber pillboxes and antitank weapons were well organized here. But what if an attempt were made to approach it from the rear?

The battalion commander assigned Sr Lt Ivanov this difficult mission. At this time his subordinates were continuing to press the "enemy" toward the canyon.

"The opposing side must be made to feel that company strength is on the wane," said Capt Kobylyanskiy to the company commander. "To this end create the appearance of engineer organization of the terrain for defense, and assign one platoon to maneuver to the 'enemy' rear."

The choice fell with the platoon commanded by Lt A. Yermolin, whose personnel were distinguished by high mountain schooling and endurance. A subunit of flamethrower personnel was attached to it.

Lt Yermolin had good knowledge of the force of this weapon. He had read about this more than once in books about the Great Patriotic War. He recalled one episode in particular. In December 1941 a separate flamethrower company commanded by Lt M. Sobetskiy struck fascist tanks with a salvo and stopped them north of Naro-Fominsk. That day the Hitlerites just did not succeed in penetrating to Moscow along the Minsk Highway. The officer had many occasions to observe actions by present-day flamethrower personnel at the range. He admired how swiftly and unexpectedly they would move ahead of the attacking skirmish line and send out an avalanche of flame toward the "enemy" in a single instant... After their "work" it was considerably easier for the motorized riflemen to advance. And now his subordinates were to attack the "enemy" under cover of the flamethrower personnel.

The flamethrower personnel arrived at the designated time. They were stalwart and had heavy knapsacks on their shoulders. Lt Yermolin immediately sensed that it would not be easy for them to cover the mountain route as the equipment was rather heavy. He cautiously asked Sr Lt A. Sereda, who was in charge of the flamethrower personnel:

"Won't you fall behind? It's a long path over the cliffs. No short halts are anticipated..."

To this Sr Lt Sereda answered curtly:

"Our people have been in the mountains more than once and are accustomed to difficulties..."

The soldiers, wearing white camouflage suits, began the concealed advance toward the mountain ridge in the twilight. Fierce fighting continued on the right and left. The artillery cannonade did not die down. The motorized riflemen and flamethrower personnel withstood the difficult night march over the mountainous terrain honorably. As anticipated, the "enemy" did not expect an attack from the rear at night from what appeared to be an inaccessible rocky sector.

The flamethrower personnel were first to swoop down on the strongpoint. An avalanche of fire cut through the darkness of the night. Antitank weapons and "infantry in trenches" were destroyed. Sgt Zh. Amirtayev and Pvt I. Chebotar' distinguished themselves in particular here. Taking advantage of the defenders' confusion, they made their way to the earth-and-timber emplacement and conducted flamethrowing inside through its embrasures...

The platoon attacked the "enemy" from the rear precisely at the designated hour. During this same time other subunits of the motorized rifle battalion began an attack from the front. The motorized riflemen's attack was irresistible.

Mountain Training Exercise

Moscow KRASNAYA ZVEZDA in Russian 6 Feb 82 p 2

[Article by Col I. Levochko and Engr-Maj Yu. Basenko, Red Banner Transcaucasus Military District: "Troop Field Schooling: According to a Complicated Variant"]

> [Text] We would like to see articles more often in the pages of the newspaper revealing experience in preparing subunits for mountain operations. (From presentations at a KRASNAYA ZVEZDA readers' conference by Col I. Klimov and Lt Col A. Grigor'yev.)

A blizzard raged in the mountains for two days in a row. During this time the infantry fighting vehicles of the motorized rifle company commanded by Capt V. Artemov twice left the starting point of the driving course and twice returned. They ascended to the near turns of the mountain route almost with zero visibility and returned without having penetrated through the thick snowdrifts.

The elements calmed down on the third day and the company again moved onto the course. After the condition of obstacles had been checked, the command "Forward!" came from the CP. Stopwatches clicked on the table of the problem director, combined unit staff officer Col P. Moskvitin, and in the hands of officers on the tower. The column of BMP's [infantry fighting vehicles] rushed upward to the first "test" run on the mountain course.

We will note that this was not a very ordinary problem. It more resembled an experiment. A number of new elements were being tested on the course for driving infantry fighting vehicles as part of a subunit in the mountains.

Officers of the combined unit staff together with specialists of the district combat training and military educational institutions directorate carefully analyzed the experience of exercises and various problems held in the mountains, studied capabilities for improving the schooling of driver-mechanics, and proposed to add a number of more difficult obstacles to the combat vehicle mountain driving course. They proceeded from the assumption that demands on troop mountain training have risen considerably of late. They also took account of recommendations of superior headquarters for increasing the schooling of combat vehicle driver-mechanics.

The course in the high-mountain training center at an elevation of over 2,000 m above sea level fully meets conditions of the corresponding exercise and, in addition, now includes certain additional elements. They include such obstacles as a humpbacked bridge over a washout, a half-tunnel with limited roadway, an ascending serpentine, and a multispan treadway bridge across a deep canyon.

Of course, the company did not go out onto this course at full strength all at once. Prior to this, extensive preparatory work was conducted with subunit personnel. The class instructor familiarized the motorized riflemen with exercise conditions, gave them an opportunity to study them, told about the course features and described each obstacle in detail. Only after this did the company go up into the mountains. A class was held here on the course during which the exercise was worked first by the numbers by platoon.

After each practice the officers carefully analyzed results. The first lessons were learned. It was noted, for example, that the serpentine with its sharp turns is rather difficult from the standpoint of driving techniques. The moral-psychological conditioning of driver-mechanics chiefly was tested at another obstacle, the half-tunnel. Initially some of them pressed too closely to the wall and scraped the track against the rock in fear of falling from the cornice into the abyss. But these difficulties were concentrated as a complex at the high-altitude bridge over the canyon. Both a feeling of fear and lack of confidence in their skills told here in the soldiers' actions during the first practices.

Subunit officers had to use many methods techniques to assist subordinates in mastering skills of correct negotiation of obstacles and stepping over the psychological barrier. For example, during practices at the half-tunnel, serpentine and high-altitude bridge the soldiers were trained to act on the obstacles by the dismounted tank training method. The personnel also were trained in driving combat vehicles in a sector covered with ice. The officers' personal example also meant a great deal. The first to negotiate the obstacles were vehicles where the battalion technical supply officer, Capt L. Zaymak and company commander Capt V. Artemov--specialists with high ratings--were at the controls.

Then came the first trial circuit of the mountain course at subunit strength. There was strained silence in the tower. At times one could hear clearly the noise of stopwatches in the officers' hands. Everyone was carefully observing what was happening on the course. How much time would the company take to negotiate the difficult route and would it compare with the estimated time? What speed would the vehicles develop? Was the people's training sufficient? What were the real criteria for determining grading indicators?

The company passed over the humpbacked bridge and the half-tunnel without delay and began entering the "snaking" serpentine. One sensed from the side how difficult it was there both for the people and vehicles. The noise of engines carried to the tower. "Gasping" from a lack of oxygen at the high altitude, the BMP engines were not developing the necessary power, but the vehicles still clambered stubbornly upward, here showing their best qualities which the designers had put into them, and went where it seemed impossible to go.

"Everyone is going well, and 88 excellently!" uttered one of the officers, glued to the eyepieces of the stereoscopic telescope.

As a matter of fact, the infantry fighting vehicle with two "eight's" on its side was ascending the serpentine confidently and did not make a single second run on the turns. The BMP even took the final, sixth, and especially difficult turn on the move. Pvt G. Mikhaylyan was at its controls. His position is gunner-operator, but he successfully mastered the related specialty of driver-mechanic, passed it for a second class rating, and the company commander entrusted him with driving the vehicle in this difficult test.

The other BMP's also were driven by no less experienced soldiers. The majority of them were first or second class specialists. It is the tradition of

motorized riflemen of this company, one of the best subunits in the regiment, to be masters of military affairs and to perform assigned missions excellently. And this time as well, many of them demonstrated excellent skills. For example, privates B. Babayev and E. Minasov took the vehicles over the course faultlessly and without making mistakes.

I also recall the following episode. The track flew off a combat vehicle being driven by Pvt V. Salamov at a turn of the serpentine during one of the practices. His comrades, privates M. Mamedov and G. Mikhaylyan, came to his aid. The soldiers worked in freezing temperatures and in a penetrating wind with snow, but they put on the track in the shortest time period and quickly returned the vehicle to formation.

The company also went confidently over the high-altitude bridge. It is true that some driver-mechanics still dawdled and took a rather long time "taking aim" on the obstacle, and so gaps appeared in the column in places. But soon the interval established between vehicles was restored and the company continued movement successfully.

Now there was not one manmade obstacle ahead; just the pass and, behind it, a steep descent. There appeared to be every opportunity to make up for lost time, but the deep snow cover, areas with layers of ice and, in some places, thawed ground did not allow top speed to be developed.

Despite the difficult conditions the company kept within the estimated time. But perhaps there are reserves which would allow saving extra minutes on the course. The officers discussed this question during an exchange of opinions and in analyzing results of the first run. Col Moskvitin saw these reserves in an increase in the driver-mechanics' proficiency. Maj V. Galochkin made businesslike suggestions. The officer recommended in particular the optimum variant of gear selection in negotiating each obstacle. He also expressed an assumption that speeds on the route might rise by almost 25 percent in summer, when it became dryer.

After a critique conducted by the class instructor with all subunit personnel, the infantry fighting vehicles went on another circuit. Looking at the stopwatches, the officers noted with satisfaction that the company bettered the movement timetable. The people had a "feeling" for the route, gained skills in negotiating the obstacles, and confidence in their actions rose. The subunit came to the finish line after shaving a few more minutes from the estimated time.

The company passed a difficult test. It showed that the effectiveness of classes for practicing the technique of driving combat vehicles on a high-mountain course is much higher than it was before, when the exercise was performed under conventional conditions. The persistent search for a more complicated variant of the exercise to improve the BMP driver-mechanics' mountain schooling was crowned with success.

We left the training center a few days later. In that hour a column of BMP's was ascending to the high-mountain course. This was another subunit in the combined unit. The school for experts of negotiating mountain roads had begun to function.

Offense Exercise with Air Support

Moscow KRASNAYA ZVEZDA in Russian 6 Feb 82 p 1

[Article by KRASNAYA ZVEZDA correspondent Col V. Bogdanovskiy, Group of Soviet Forces in Germany: "Motorized Riflemen Go Into the Attack"]

[Text] A field fire exercise is under way with the motorized rifle battalion in which Gds Sr Lt V. Korobov is acting commander. The exercise director briefs the situation: After suffering defeat in previous fighting, the "enemy" has assumed a hasty defense and is drawing up reserves from the depth in an attempt to prevent attackers from seizing a tactically favorable line. The attackers are trying not to allow the "enemy" to consolidate...

Then suddenly fire support helicopters appeared from behind a forest. These were helicopter pilots led by squadron commander 1st Class Military Pilot Lt Col V. Nikonorov coordinating with the motorized riflemen and supporting them by fire from the air.

When the "enemy" weapon emplacements and personnel had been neutralized reliably, the rotary wing craft reappeared over the field, this time with a tactical airborne assault force aboard. Leaping from the hovering helicopters, the soldiers immediately rushed forward. The subordinates of Gds Capt A. Yefimenko, Gds Sr Lt M. Zuyev and Gds Sr Lt P. Petrenko acted boldly and resolutely. They destroyed surviving "enemy" personnel in strongpoints with accurate fire.

All this created favorable conditions for the motorized riflemen's further attack. Now it was important not to lose time. As before, a hail of fire fell on the "enemy" positions. It could be easily seen from the observation post how the infantry fighting vehicles emerged swiftly from behind the hills and took up a combat formation, concealed by folds of the terrain.

The battalion headed into the attack. Machinegun and submachinegun bursts intermingled with the artillery cannonade. Targets fell one after the other. The motorized riflemen acted precisely and resolutely. Gds Sr Lt Korobov requested increased fire first on one then another axis. His instructions were laconic. The very same commands were being given by company commanders guards senior lieutenants A. Khitrov, Yu. Kuznetsov and N. Semenov.

"This exercise is a difficult test for the personnel," said Gds Sr Lt Kuznetsov prior to it. "It has been a little over two months since the beginning of winter combat training. This is not so much if one considers that the company has many young privates. They are taking a responsible test of maturity."

"I would like to recognize the platoon commanders' training," continued the officer, "that of Sr Lt Sergey Trushechkin, Gds Lt Sergey Afonin and Gds WO Aleksandr Gergaladze. I'm sure that they will not become confused in the most difficult situation."

...The attack continued, with the "enemy" undertaking a counterattack. After estimating the situation correctly, Gds Sr Lt Korobov made the decision to

repulse the counterattack by fire from in place. The companies moved forward swiftly to a favorable line together with the attached tank platoons. In this phase tankmen of the company commanded by Gds Sr Lt A. Zhukov demonstrated excellent schooling. Rocket launcher personnel demonstrated high weapons proficiency. This is natural. It has become a tradition for battalion personnel to struggle to hit targets with the first round. During the last training year the battalion honorably fulfilled its socialist pledges and received the right to be designated outstanding. This year as well the guardsmen are celebrating the year of the 60th anniversary of the USSR's foundation with outstanding results in socialist competition, and their actions in the exercise attest to this.

Arm Gen A. A. Yepishev, chief of the Main Political Directorate of the Soviet Army and Navy, observed the exercise and gave high praise to the personnel's tactical and weapons schooling, commended the guardsmen and wished them new success in combat and political training. Valuable gifts were awarded to those who distinguished themselves most, including Gds Maj V. Bol'shenko, guards senior lieutenants V. Korobov, Yu. Kuznetsov, A. Zhukov and Yu. Komarov, and Gds WO S. Kibirev. The exercise also was attended by Arm Gen M. Zaytsev, CIC of the Group of Soviet Forces in Germany; Col Gen I. Gubin, member of military council and chief of Group political directorate; and by Guenther Jahn, first secretary of the Potsdam Bezirk Committee of the SED [Socialist Unity Party].

Training Problems Discussed

Moscow KRASNAYA ZVEZDA in Russian 3 Mar 82 p 2

[Article by Col I. Kikolenko, inspector of organizational-party work department of Southern Group of Forces political directorate: "Toward the All-Army Conference of Primary Party Organization Secretaries: The Right to Authority"]

[Text] Submachinegun bursts were heard beyond the window of a diminutive room called the headquarters at the training center. They would first split the cold night furiously, then would die down for a time. As he conversed with me Lt Col D. Sokolov kept a keen ear on this rhythmic nature of the fire. In the next more lengthy pause the regimental party committee secretary suddenly pricked up his ears, then suggested:

"Let's go to the battalion. Apparently something is wrong there."

At the control point the battalion commander was scolding the operator roundly.

"What happened, Vladimir Nikolayevich?" Sokolov asked him.

Getting cold, the latter said:

"They report that the display stopped functioning."

"Did you check it yourself?" The battalion commander stopped short.

"Include me in the next section of firers," the party committee secretary requested of him.

When he departed I began to suffer for him, but the short, tight bursts heard at the line relieved the tension: The display immediately lit up. The operator commented happily:

"Lt Col Sokolov always fires excellently."

Disan Sergeyevich returned dissatisfied.

"The motorized riflemen are making many mistakes," he said and, turning to the battalion commander, added: "The people are not ready for firing. They aren't able to locate targets. It has nothing to do with the display. It's completely in order."

To be sure of his conclusions once and for all, the lieutenant colonel went once again with the next section, this time without a weapon. His conclusions were confirmed: The privates were not finding the targets. They were poorly trained in this.

"Ammunition shouldn't be wasted for nothing," remarked Sokolov. "Practices are needed."

"You probably are right," agreed the battalion commander. "But what is to be done with the plan? The regimental commander approved it... What do you think?"

"Never mind," responded the secretary, "I'm sure that the regimental commander will understand correctly."

"Well, then that's what we'll do," decided the battalion commander and left to issue instructions.

The party committee secretary made a note in his notebook: "Find out how the party members are struggling for quality in the personnel's schooling and bring up this matter at a party meeting."

I heard Lt Col Sokolov's name for the first time in combination with the word "authoritative." One of the Group of Forces political directorate workers was telling about him. Now I saw confirmation of this. On what does the authority of a party leader depend? On how closely he is connected with people, how thoroughly he knows their life, work and needs, how promptly he responds to them, and the extent to which he is able to conduct the fundamental party line in everything. And it is not only on this--there are many components of authority, but it takes shape from this, from apparent details and trivial matters. And he has to be "fed" good deeds each day because, like a flower that does not receive life-giving moisture, he might wither. But it is not enough to be just businesslike. The businesslike nature of the secretary has to be on friendly terms with sincerity, and Disan Sergeyevich has more than enough of this.

Take a recent incident for example. Failures in work suddenly began for one young officer and he became a kind of nervous, harassed person. What was the reason here? The officer's superiors took this up, chatted with him and advised him how to arrange his service, but they just did not get down to the primary causes. Everything began with "personal matters," as they say. The party secretary helped the young person understand family relationships. He did it delicately, unobtrusively and, most important, sincerely.

And I will repeat once again: A secretary will be equal to things as long as he has principle. It is at times difficult to defend one's own opinion. It is necessary to have firmness of convictions and purposefulness here, but at the same time also self-control and tact.

The news that battalion commander Capt R. Khakimov committed an undignified act outside the unit area was like thunder out of a clear blue sky. Khakimov, who had been praised and set as an example and who had taken the battalion into the ranks of foremost, and suddenly this. One didn't want to believe it. "Perhaps it is a mistake or misunderstanding," the party committee secretary reassured himself. But the very first meeting with Khakimov dispelled doubt.

"Yes, it happened," Khakimov said, dispirited. "I don't even know how I lost control of myself."

"How can that be?" Sokolov reflected bitterly on the battalion commander. "He behaves faultlessly before the collective's eyes, speaks to colleagues with good, proper talks, calls on them to be the example in everything, but he himself..."

These reflections generated annoyance at himself in the secretary's heart. They exposed flaws in his work with the party members. The fact is that he too had praised Khakimov and set him as an example. He praised him for organizational abilities and for zeal in service. And everything generally was correct. The person deserved to be praised. The mistake lay elsewhere, in the fact that he, Sokolov, had sufficient job qualities of Khakimov's to consider him a model. But how does he behave off duty? How does he live? What are his hobbies? What does he read or does he read at all? And finally, what are the motives for his zeal in service? Here the secretary admitted to himself that he had taken almost no interest in this aspect of Khakimov's life.

Disan Sergeyevich shared his unhappy reflections with the regimental commander.

"There is no denying that we blundered," the latter agreed, and added in reflection: "But this in no way excuses the captain. He should be punished in all severity."

Sokolov and other members of the party committee adhered to the very same opinion, but the committee session did not go as expected. The regimental commander himself vacillated in his initial resolve. In speaking, he said that allowances had to be made for Khakimov--give him a severe reprimand, but without entry in the record, as other members of the party committee wanted. What motivated the commander to take this viewpoint? The fact that the

captain was serving well and had taken the battalion into the ranks of foremost. And then, this year Khakimov was to receive his next promotion in rank and how can a recommendation be sent if a reprimand is registered?

Disan Sergeyevich listened to the commander and felt that he could in no way agree with him. And when the commander had finished, the secretary immediately took the floor.

"It is true," he began, "that Khakimov works well. But this doesn't give him the right to violate our moral norms. Allowances will not be of benefit to him, of this I am sure."

The majority were in agreement with this viewpoint and Khakimov was given a severe reprimand with entry in the record.

On returning to his office the commander began work on the papers awaiting him, but his thoughts returned him again and again to the party committee session which had just ended. The fact that his proposal had not found support offended him, but gradually a doubt matured in the depth of his soul: But am I myself right? The fact is that initially Khakimov's infraction made me indignant, but later... Later there were considerations... Or more correctly, a simple "worldly" calculation: The date for promotions is approaching...

Later he caught himself thinking that he had ceased thinking about himself, but was thinking about Sokolov.

Here was another recent instance where the party committee secretary, who had been first to discover a slump in weapons training of one of the battalions, immediately came to the commander and requested that he be sent to the training center with the companies. He returned not only with a detailed professional analysis of the reasons for the slump; he laid out on the table a plan he had drawn up for an entire complex of activities which the party organization had to implement. Field firings showed that they were very beneficial. The snipers and rocket launcher personnel received the highest grade and the other specialists received a solid good grade...

A knock on the door interrupted the regimental commander's thoughts. Maj A. Korovin entered. Glancing at him, the commander recalled that Disan Sergeyevich also had had to work with this officer in developing a party attitude toward the job in him...

The more he reflected, the more impressive and vivid the party committee secretary appeared to him. "A strong and reliable person," he concluded and felt awkward over the fact that he had taken offense in vain. After resolving the matter with Korovin quickly, he picked up the telephone resolutely:

"Disan Sergeyevich, are you free? Drop in for a minute."

Sokolov realized from his voice that the commander was smiling...

...The regimental commander arrived in the training center in the morning. After hearing the party committee secretary's report about results of the night firing, he fully approved his advice to the battalion commander. And taking me aside, he said:

"I believe that this is what a party manager has to be like."

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GROUND FORCES

HISTORY OF TAMAN' RED BANNER INFANTRY DIVISION DISCUSSED

Yerevan KOMMUNIST in Russian 14 Feb 82 p 2

[Article by Ash. Arutyunyan, former chief of political department of 89th Division, Honored Worker of Science: "On the 40th Anniversary of Activation of the 89th Red Banner Orders of Kutuzov 2d Class and Red Star Armenian Rifle Division: The Taman' Red Banner"]

[Text] In the difficult years of the Great Patriotic War the Communist Party and Soviet government made the decision to create national formations as part of the Soviet Armed Forces. During 1941 and 1942 Georgian, Azerbaijan and Armenian divisions were activated on the territory of the Transcaucasus. Of the Armenian divisions, the 89th and 409th retained their numbering and primary composition until the end of the war.

The 89th Armenian Rifle Division was activated in Yerevan in December 1941.

A regular military officer was assigned as the first division commander. He was Frunze Academy graduate Col S. Zakiyan. The military commissar was senior battalion commissar V. Chumakov, political department chief was battalion commissar A. Kirakosyan, and chief of staff was Col A. Kazaryan. The 89th Division consisted of the 400th, 526th and 390th rifle regiments, the 531st Artillery Regiment as well as separate special units and subunits.

The division's political make-up, especially the group of company and battery politruks, basically was staffed from the reserve, with many persons not having military training, but burning with desire to learn and get into the army in the field as quickly as possible. The division's units and subunits strengthened as fighting units in a comparatively short time thanks to the good organization of combat and political training and the great zeal of all personnel. Much credit goes to the CC CP of Armenia and the republic government in activating the division.

One of the unforgettable days in the division's history was 16 July 1942, when M. Papyan, chairman of the presidium of the Armenian SSR Supreme Soviet, presented the units with colors in a ceremony on Yerevan's Lenin Square.

On orders from the Supreme High Commander in August, the division's units were moved by rail to Groznyy, where the battle for the Caucasus already was under way. Anxious but firmly decisive voices were heard at the rallies where the republic population greeted and sent off soldiers, representatives of all

peoples of the Transcaucasus: "The enemy wishes to seize Soviet oil and the rich, fertile valleys of Azerbaijan, Georgia and Armenia, and enslave the free peoples of the Transcaucasus, but we know and we fervently believe that the enemy will be defeated!"

It was during these difficult days that division personnel received their first baptism of fire in fighting at Groznyy. There were both joyous days of success as well as failures here. Division personnel gave a good account of themselves from the very first days while on the combat march. This is attested to eloquently by lines from the Military Council order: "I set as an example the efficiency and high awareness of personnel of the 89th Rifle Division."

S. Zakiyan was replaced by A. Sarkisyan in the post of division commander and in October 1942 Col A. Vasilyan, who before this commanded the 409th Armenian Division and was a very experienced and brave commander, was appointed the division's commander.

The 89th Armenian Rifle Division was among those forward combined units which successfully penetrated enemy defenses and, beginning from Malgobek, the banks of the Terek, and across Georgiyevsk, Mineral'nyye Vody and Stavropol', moved to the Taman' and the shores of the Sea of Azov. Liberating dozens of populated points and cities, division personnel gradually became tempered and acquired combat experience and sharpness. There also were serious losses in personnel along this difficult path. Division commander Col Artashes Vasilyan, Maj Suren Bagdasaryan, commissar of the 400th Rifle Regiment, and many other officers, privates and NCO's died heroically.

Col N. Safaryan was assigned as the new division commander and remained in this position until the war's end. In August 1943 the 89th Division became part of the famous 18th Army (the commander was Lt Gen K. Leselidze and political department chief was Col L. Brezhnev).

For a number of reasons the German command did not wish to clear the North Caucasus completely and set up a deeply echeloned defense on the Taman' Peninsula, the so-called "Blue Line." In September 1943 Soviet troops in the North Caucasus went into an offensive to defeat fascist groupings and completely liberate the Taman' Peninsula and then the Crimea.

Attacking in the direction of Sakharnaya Golovka and Mt. Dolgaya, the 89th Rifle Division penetrated enemy defenses and superbly accomplished the combat mission assigned by the front military council. Mar SU K. S. Timoshenko, representative of the General Headquarters of the Supreme High Command, commended division personnel and on 9 October 89th Rifle Division, among divisions which had distinguished themselves, also was given the honorary designation of Taman' by Order of the Supreme High Command. Many soldiers were decorated with combat orders and medals and division commander Safaryan with the Order of Kutuzov 2d Class. He was promoted to the military rank of major general.

Beginning in November 1943 and through 10 May 1944 units of the 89th Taman' participated in amphibious operations in the vicinity of Kerch' and

subsequently in fighting to liberate the Crimean Peninsula, right up to Sevastopol'. Capt M. Muradyan (now a major general), Col Ye. Karapetyan, political worker M. Akopyan, privates S. Grigoryan, A. Oganesyan and A. Kazaryan and many others distinguished themselves in particular in liberating the Crimea while Suren Arakelyan and Unan Avetisyan received the high title of Hero of the Soviet Union posthumously for heroic exploits. Some 6,000 persons received orders and medals. The division was awarded the Order of Red Star and the 400th and 390th rifle regiments received the designation "Sevastopol'."

In 1944 the valorous troops of the Red Army basically had freed Soviet soil of the German occupiers and combat actions were continuing abroad. The Soviet Armed Forces were assigned the missions of carrying out their liberation mission with respect to enslaved peoples of Europe and defeating fascism in its own lair.

Among many combined units, the 89th Taman' Division already was fighting on Polish territory as part of the 1st Belorussian Front commanded by G. K. Zhukov beginning in August 1944. The division made an assault crossing of the Vistula south of Warsaw as part of 33d Army and moved up to the banks of the Oder River while continuing to take part in the historic fighting on the Berlin Axis.

The personnel displayed especial steadfastness on the base of operations on the left bank of the Oder. Recalling these days, Maj Gen N. Safaryan writes: "For 60 days the fighting men, NCO's and officers of the division were under difficult, severe conditions. A small base of operations which soon came to be called the 'Armenian base of operations' consisted of marshy terrain. German troops moved into counterattacks 16 times, ending in heavy losses for the enemy."

When Mar SU Zhukov issued the order on 14 April for beginning the offensive on Berlin, units of 89th Division were among the first to take the Germans' line of defense with swift assaults, earning high praise for their actions.

In late April of 1945 the 89th Division took up attack positions for an offensive in the vicinity of Frankfurt-am-Oder as part of the 3d Shock Army. Division units already were fighting in the streets of Berlin on 28 April. Fascist Germany was living out its last inglorious days. The 89th ended its combat path on the Elbe.

Armenian soldiers both in the Armenian Division as well as in other formations fought far from native villages and cities, on the vast expanses of the North Caucasus and the Ukraine, in the Carpathians, and on the territory of Poland, Romania, Hungary, Czechoslovakia, Yugoslavia, Austria and Germany. But each of them knew that no matter what the sector of front in which he was fighting the fascist hordes, he was fighting in the name of the Motherland, since the freedom and happiness of his native Armenia is linked inseparably with the freedom and happiness of all peoples of our country--herein is the essence of internationalism and the friendship of peoples.

The campaign record of 89th Division, which ended in Berlin, will remain in the history of the Armenian people as part of its grand pages.

During the division's existence it was commanded by Maj Gen G. Martirosyan; later this position was held by Hero SU Maj Gen A. Karapetyan and Maj Gen S. Miansarov. A large group of division officers underwent special training in higher military educational institutions.

Recalling his contact with Armenian Soldiers, L. I. Brezhnev writes: "My acquaintance with the Armenian people began during the Great Patriotic War. At that time I had occasion to know many courageous sons of the Armenian people, utterly dedicated to our Soviet Motherland and the cause of socialism and communism. . . . And at that time, in the days of fierce battles, I came to know the superb soul of the Armenian people."

Veterans of the famous Armenian Taman' Division proudly recall the heroic path they covered. But they do not live with memories alone. The former front-linesmen steadfastly continued to work after the war in the most responsible sectors of the national economy, science, culture and education. Even in peacetime they are setting an example of selfless labor. Hundreds of division veterans added the Order of Labor Red Banner, medals "For Labor Distinction," and badges of leaders of socialist competition to the combat orders and medals on their chests. Many perform extensive military-patriotic work among the youth. A new generation of sons dedicated to the Motherland is being indoctrinated on the grand combat traditions.

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GROUND FORCES

AIRBORNE TROOPS: NIGHT RECONNAISSANCE

Moscow KRASNAYA ZVEZDA in Russian 17 Feb 82 p 1

[Report by Lt Col E. Belyayev, Red Banner Turkestan Military District: "In a Night Raid"]

[Text] The "Afghan wind" died down toward evening. A gusty breeze licked handfuls of sand from the sand dunes and carried torn balls of camel's thorns. The blue of far-off sand dunes disappeared in a solid haze of dust.

Airborne battalion commander Maj Azat Annamuradov shook his head as he listened to the howling of the wind:

"It is apparent from everything that the scouts will have to sit out this night."

Sr Lt Mikhail Ivanov frowned at these words as if from a toothache. One could understand him: Everything had been ready for the raid for a long while. The people were in the mood for night operations. Lt Tair Kadymov should be driving up at any moment. He had been assigned to clarify the final details of coordination with the subunits through whose combat formations we were to infiltrate to the "enemy" rear that night.

"I think the ambush still has to be accomplished, Comrade Major. The 'enemy' will not pass up a chance to use the bad weather... And the wind will die down by midnight..."

The "Afghan" abated just as suddenly as it had begun. In a matter of minutes the airborne personnel were assembled. They draped themselves with cartridge pouches containing magazines and grenades and laid in a supply of dry rations and water--it was to be a long way over the mountain trails.

They formed up. At a command they jumped around to see whether or not something would make noise in their gear. There were no sounds at all, although each person had on his back a backpack filled with ammunition, a submachinegun and grenades.

Twelve persons stood shoulder to shoulder in formation. I will give all their names because it is impossible to isolate someone in particular. All of them had been tested repeatedly by practice combat in the most difficult conditions of mountains and desert.

In formation were junior sergeants Grigoriy Zakabunya and Il'yas Urinbayev, privates Tenyzbek Nukibayev, Viktor Kolobovnikov, Igor' Makogonenko, Oskar Maldybayev, Viktor Kostenko, Sultangary Gabitov, Nail' Shakirov, Viktor Pantyukhov and Sergey Kireyev, and Lt Tair Kadymov. They stood facing Sr Lt Ivanov.

For some reason at that moment the company commander had the thought that each one of them had a native home, mother, father, fiancee or wife.

Igor' Makogonenko's year-old son Serezhka probably was quietly snuffling in his sleep at home and the moonlight possibly had laid silvery threads on the Pripyat' and Desna, those very rivers in which helmsman Makogonenko had swum before service in the Army. Invisible threads connect Viktor Pantyukhov with his native Apsheron. Il'yas Urinbayev possibly sees a cotton field...

The military formation, where each one could feel his comrade's shoulder, stood in close ranks.

"It's time," commanded Sr Lt Ivanov in an undertone and he turned sharply. The living chain stretched out behind him into the night. They went one after the other, step for step, as if over a minefield.

After 15 minutes of a fast pace, everyone froze and listened to the silence. That was the procedure. They would listen and again move out.

The company commander decided to move to the ambush location from the bushes. The group lay down in front of the undergrowth. Three persons moved out along the route--privates Zakabunya, Kolobovnikov and Nukibayev.

The airborne men moved to the designated location in two groups. Ivanov and three privates placed themselves on the slope, where, as he said, it was "surer and harder." Lt Kadymov gave me a place next to himself. Tair is short and broad as a barrel; on the other hand, it seems he is knit entirely of strong, resilient muscles. He was born and went to school in Baku.

Sounds of practice combat came from the left. Far off behind the hills where the edge of the range was scorched with flame, the airborne personnel were defending. The "enemy" was pressing, but for now his efforts were unsuccessful. This was sensed from the increasing fire. As Ivanov assumed, the "enemy" could not get by without replenishing ammunition prior to the next attack. This could be delivered only along this road, which the two groups of airborne personnel now straddled.

The fighting flared up stronger and stronger. Tracers stitched across the sky and burned intricate geometric figures. The radio shrilled and immediately gave out with a solid rustle as usual. The radio operator in Ivanov's group pressed the cut-out switch and a signal carried to us: "Everyone get ready."

It already was light when we returned to the compound. Sr Lt Ivanov went to report results of the raid. The airborne men made ready to retire and soon they already were sleeping. They slept the healthy sleep of very tired

people. Sounds carried from the range: The mortar battery attached to the battalion was firing against targets which we had discovered during the patrol.

Day was breaking. I knew that the soldiers would have another patrol on the following night, and they knew this...

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GROUND FORCES

ARTILLERY UNIT: TRAINING PROBLEMS

Moscow KRASNAYA ZVEZDA in Russian 24 Feb 82 p 2

[Letter by Gds Sr Lt V. Labayev, Gds Lt I. Sal'nikov and Gds Lt M. Tal'yantsev and commentary by KRASNAYA ZVEZDA correspondent Lt Col V. Shchekotov, Red Banner Ural Military District: "Letter With Commentary: Sham Characteristics"]

> [Text] Dear Editors! Before assigning the NCO's who came to us from an artillery training subunit to positions, we checked the level of their training. It turned out that they were far from meeting existing requirements. The grades given in the certificates showing their completion of the training subunit were inflated. Conclusions contained in official appraisals signed by training platoon commanders Sr Lt A. Endeberya and Lt A. Osipov also were not confirmed. We believe this to be completely inadmissible.

First of all we will note that KRASNAYA ZVEZDA already has written about deficiencies in the training of NCO's in the given artillery training subunit. This was the subject of the article "They Didn't Study Enough..." published on 31 July 1979. The later response to the newspaper's criticism announced steps to remedy shortcomings.

Then I was in the subunit again. Col L. Karapetyan, deputy commander of district missile troops and artillery, was there and, after learning the purpose of my arrival, remarked bitterly that the letter's authors unfortunately were correct: Even now there still are gaps in the cadets' training. In his opinion, they largely are caused by deficiencies in the officers' professional training.

Well, it is difficult not to agree with this. Take for example Lt Osipov, whose signature is at the bottom of appraisals of Jr Sgt M. Leushkanov and Sgt I. Khasanov. Training battery commander Sr Lt N. Musiyenko admits that the level of Osipov's professional training meets requirements far from completely. Should one be surprised that the people he taught artillery matters are poorly trained?

With regard to the appraisals of the training subunit's graduates, it turns out that they were drawn up following a single example. This then explains the fact that they resemble each other like two drops of water.

But it would be unjust to accuse the training platoon commanders of everything. This is why. As was learned in a discussion with the officers, they sometimes have to perform appraisals of cadets with whom they are barely acquainted inasmuch as those cadets are engaged in matters quite remote from the training process for almost the entire training period. In particular that was the case with those mentioned in the letter as well. For example, one of the cadets worked as a plasterer in construction of a training facility almost the entire training period.

There are frequent cases where training subunit officers themselves are taken away for all kinds of unscheduled activities and administrative projects not connected with the training process. Take this same Lt Osipov, who experiences serious difficulties in working with people due to insufficient competency in matters of methodology. He spent much time with subordinates on various projects in the district military sanatorium. Many other officers also worked there with subordinates during training time.

It stands to reason that this was not done at the wish of the subunit officers. As documents indicate, the initiative stemmed most often from higher echelons, including district headquarters. And if one of the officers, such as Capt N. Chuvashov, acting commander of the artillery training battalion, tried to remind his senior comrades about the inadmissibility of diverting personnel from classes, he would be put in his place, to put it mildly.

There are other kinds of difficulties which hinder the training subunit's officers in accomplishing the missions facing them with high quality. They involve, for example, shortcomings in providing them with necessary literature. In particular, the subunit lacks technical and special training textbooks. That which could be acquired in the military exchange stores already has been acquired, but this is not enough. Other ways must be sought. For example, Sr Lt V. Stenyakin told me how he traveled to the Sverdlovsk Higher Military-Political Tank-Artillery School during his last leave to "borrow" a few special training textbooks there. This of course is not a solution to the problem. For example, to this day the battalion where Capt Chuvashin serves has only a few of the "Spravochnik serzhanta artillerii" [The Artillery NCO's Reference]. The fact is that NCO's whose training level is not high enough to get by without a textbook hold many classes with cadets.

Nevertheless, the aforementioned deficiencies and difficulties in organizing the training process cannot serve as justification for those officers who showed irresponsibility in writing official appraisals of cadets. This can be called nothing other than eyewash. It remains to hope that this instance will be evaluated fundamentally.

We also cannot fail to mention that many shortcomings mentioned earlier in the article "They Didn't Study Enough..." are being repeated even now. It follows that the steps to remedy deficiencies noted by the newspaper, announced at that time in response to the editors, still have not been completed.

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GROUND FORCES

TANK UNITS: CHANGE OF CONDITIONS ON OFFENSIVE

Moscow KRASNAYA ZVEZDA in Russian 26 Feb 82 p 1

[Article by KRASNAYA ZVEZDA correspondent Lt Col L. Golovnev, Order of Lenin Moscow Military District: "When the Situation Changed"]

[Text] A reinforced tank battalion commanded by Gds Maj V. Dorokhin swiftly approached the line of departure. The artillery already was hitting the detected targets in the "enemy" strongpoints to its utmost and aircraft were delivering bombing strikes. Combat engineers were making passages in minefields and engineer obstacles using rocket charges. In short, the dynamics of practice combat rose with every passing second.

Then finally came a tank attack. It essentially was the culmination of the fight. The high speed of the fighting vehicles, fire accuracy of tankmen and personnel of reinforcing subunits, and the ability of the battalion commander and other officers to control personnel and weapons in the difficult tactical situation--all this was manifested with special force at the moment of the attack and, of course, contributed to success of the field fire exercise as a whole.

But the intensity of combat did not drop even after penetration of the forward edge of defense. It turned out that the defenders' main body was disposed in a second echelon. Moreover, the "enemy" had a strong tank reserve...

But all this was learned later. Right now the battalion was continuing to attack and it seemed to Gds Maj Dorokhin that success could not be in doubt.

But he was wrong. Not having accurate data on the "enemy," the battalion commander aligned the combat formation in such a way that the attackers' main body was in the first echelon. There was only one tank platoon in reserve. Even with artillery and air support this clearly was insufficient to repulse the imminent counterattack by "enemy" tanks.

That is what happened. The "enemy" tanks and motorized infantry counterattacked the battalion on the left flank. Dorokhin threw his entire reserve against them, but the platoon was not able to stand up against the superior "enemy" forces. Gds Maj Dorokhin would have liked to retarget the company commanded by Gds Capt G. Nikiforov, operating nearby, to repulse the counterattack, but this too proved impossible. The company had moved far forward and one platoon was already fighting on an intermediate "enemy" defense line. Another platoon headed by

Gds Sr Lt N. Seliverstov was repulsing a helicopter attack at this time, so that Nikiforov was able to move only one platoon forward to meet the counter-attacking tanks.

It is difficult to say how this fight would have ended had not the artillery-men arrived in time. Their fire held up the "enemy" tanks for some time and gave Gds Maj Dorokhin an opportunity to take more effective steps to repulse the counterattack.

Some time later the battalion commander again got into a difficult spot. Attackers encountered stubborn "enemy" resistance where they had not expected it. Here the success of the company commanded by Gds Sr Lt A. Rudnyy could have been used. It was attacking the "enemy" decisively and had crowded him back. But Dorokhin no longer had forces at his disposal to support it. Moreover, motorized riflemen attached to the battalion had fallen behind the tanks.

There were many other situations in the exercise where commanders were required to show initiative and tactical boldness, and many of them did reveal these qualities. For example, motorized riflemen commanded by Gds Sr Lt V. Radchenko and the artillerymen headed by Gds Capt V. Sidorenko coped successfully with their missions in the difficult situation. But shortcomings in some officers' training also made themselves known, which affected the battalion's overall grade. In particular, reconnaissance functioned poorly, including the intelligence officer of the supporting artillery battalion, Gds Lt V. Shcherbakov. The scouts did not always accurately uncover the "enemy" forces, weapons and fire plan, which hindered the battalion commander in making substantiated decisions promptly.

Actions in the sharply changing situation showed that some officers still lack independence, skills in estimating the enemy, and an ability to update and adjust a previously made decision where necessary.

In short, this exercise, which was observed by USSR Deputy Minister of Defense Mar SU K. Moskalenko, was a good lesson for the officers. Its results are orienting them on a further improvement in their professional expertise and in the personnel's field schooling.

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GERMAN SOURCE ON TANK DEVELOPMENT

Frankfurt/Main SOLDAT UND TECHNIK in German No 3, Mar 82 pp 130-139

[Article by Senior Construction Counsellor Engineer Rolf Hilmes: "Thirty Years of Battle Tank Development, 1950-1980--Part II. Development of Component Technology"]

> [Text] After a description of the development of tank design between 1950 and 1980 in terms of time in Part II, the following chapters will present the most essential development steps in the components sector; for greater clarity, we will concentrate here on firepower, mobility, and survivability as system characteristics.

1. Firepower-Determining Structural Components

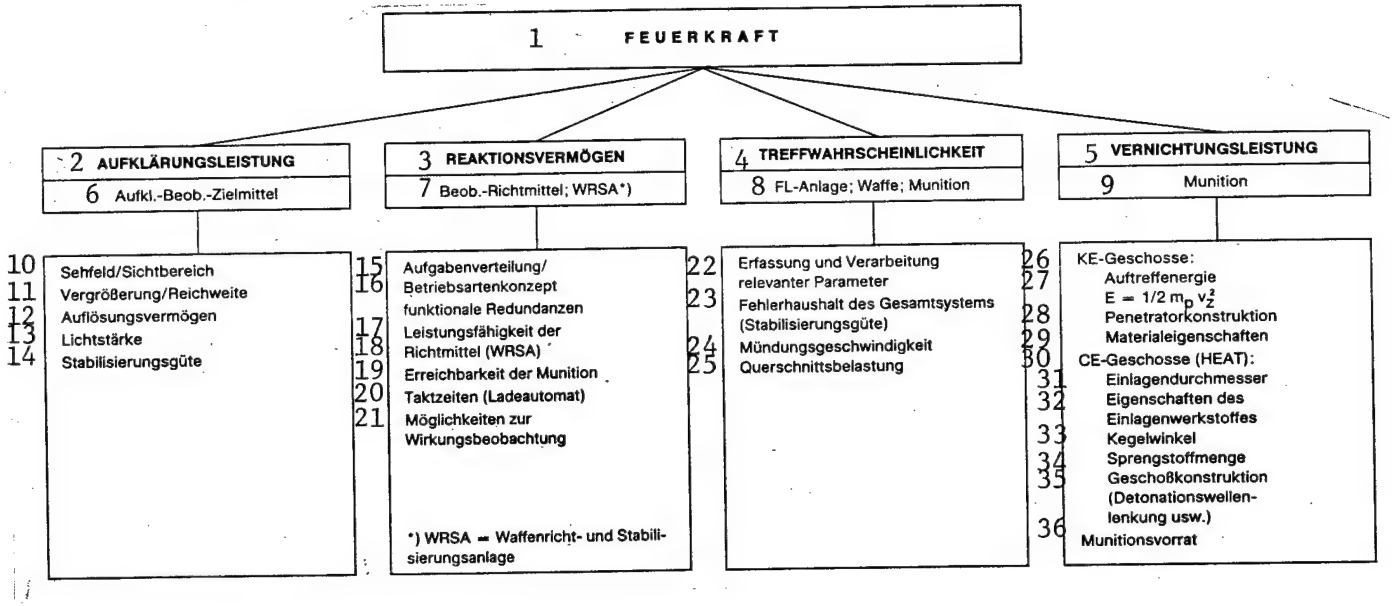
From the tactical viewpoint, a battle tank's primary mission is to destroy enemy battle tanks in the shortest possible time after they have been discovered. The functional characteristics which are significant in the accomplishment of this task are compiled in Table 2.

Strictly speaking, a battle tank's development starts with the ammunition or with the definition of the effective ammunition performance. The penetration performance required here, among other things, determines:

In the case of CE [chemical energy] ammunition (HEAT, HESH, etc.), the weight of explosives to be carried along as well as the filler diameter (in the case of HEAT), in other words, in the final analysis, the caliber of the main armament;

In the case of KE [kinetic energy] ammunition (APDS, APFSDS, etc.), the weight of the projectile and the required muzzle velocity, in other words, in the final analysis, the dimensions of the space for the charge and the length of the barrel.

Table 2. Fire Power-Determining Functional Characteristics of a Battle Tank



Key: 1--Firepower; 2--Reconnaissance performance; 3--Response capability; 4--Hit probability; 5--Destruction performance; 6--Recon, obsn, aiming eqpt; 7--Obsn, aiming eqpt WRSA; 8--Fire control system; weapon; ammunition; 9--Ammunition; 10--Field of vision, range of visual observation; 11--Magnification, range; 12--Resolution capacity; 13--Light intensity; 14--Stabilization quality; 15--Task distribution; 16--Concept of types of operation; 17--Functional redundancies; 18--Aiming equipment capacity (WRSA); 19--Ammunition within reach [reachability]; 20--Cycle times (automatic loading mechanism); 21--Effect observation possibilities; 22--Recording and processing of significant parameters; 23--Error estimates for overall system (stabilization quality); 24--Muzzle velocity; 25--Cross-section stress; 26--Kinetic-energy projectiles; 27--Impact energy; 28--Penetrator design; 29--Material properties; 30--Chemical-energy projectiles (HEAT); 31--Filler [insert] diameter; 32--Properties of filler material; 33--Cone angle; 34--Explosive quantity; 25--Projectile design (blast wave guidance, etc.); 36--Ammunition supply; WRSA--Weapon aiming and stabilization system.

In addition to the required destruction performance, it is necessary, by means of corresponding design and adaptation of ammunition, weapons, and fire control system, to achieve adequate hit probability under varying marginal conditions. High-grade reconnaissance, observation, and aiming equipment should lead to a high discovery probability and, in combination with a favorable task distribution among the crew, it should lead to the shortest possible reaction time between the discovery of the target and the moment the first round is fired.

What are the developments in the firepower-determining components of the battle tank over the past 30 years?

Main Armament

The main armament of the medium battle tank of the early 1950's essentially was the result of efforts to develop a weapon superior to the German 88-mm tank gun. In the United States, that led to the development of the 90-mm L/48 gun for the M-26, M-46, M-47, and M-48 tanks in 1945; Great Britain came out with the 83.4-mm L/70 tank gun for the Centurion 3; in the Soviet Union, the 100-mm AT gun dating back to World War II was modified and it was used on the T-52 tank for the first time as a tank gun; (it was also used in the SU-100 assault gun). As we can see from Table 3, the Soviet Union at that time was able to take the lead in the main armament for battle tanks of the first postwar generation. All weapons are air-tube cannons with smoke exhaust units.

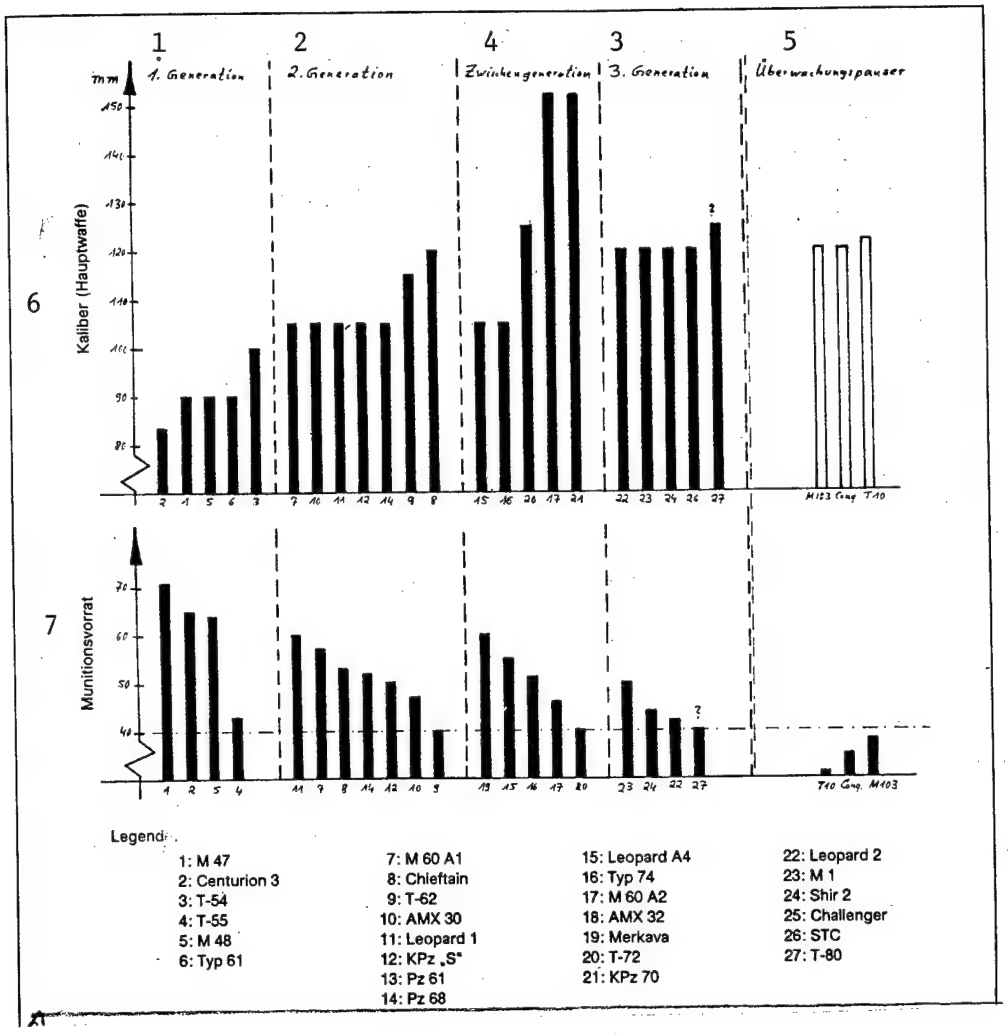
The second postwar generation of the medium battle tank appeared during the 1960's; this was the era during which the British 105-mm L/51 tank gun by Vickers came into widespread use throughout the world in the West. In keeping with British philosophy, there was an APDS projectile for this weapon which was quite efficient, for those days, and a "soft-nose" projectile (HESH) which was declared to be a multipurpose projectile; but there was no hollow-charge projectile. This type of projectile was developed by the United States during the early 1960's so that users of this weapon received an ammunition assortment with the most varied operating principles to engage hard and semihard targets. The 105-mm tank gun was autofretted for the first time (prop autofrettage) so that an astonishingly high design gas pressure (more than 5,000 bar) was achieved, considering the state of the art at that time.

The British 105-mm tank gun was not introduced in France; instead, the 105-mm L/56 DEFA tank gun was made here for the AMX-30 battle tank; until the beginning of the 1980's, only a twist-jacket-stabilized hollow-charge projectile was available for it (Figure 33).

Interestingly enough, the performance level of the 105-mm tank gun was no longer considered adequate for a vehicle of the second postwar generation in the country that first originated that gun during the development phase of the Chieftain tank; instead, an 120-mm L/55 gun was planned for that tank already in 1955. Only the Centurion (a vehicle of the first postwar generation) was converted to the 105-mm tank gun.

Table 3 (top). Development of Main Armament Caliber in Battle Tanks, 1950-1960.

Table 4. Development of Ammunition Supply for Battle Tanks, 1950-1980.



Key: 1--First generation; 2--Second generation; 3--Third generation; 4--Interim generation; 5--Surveillance tank; 6--Caliber (main armament); 7--Ammunition supply; KPz--Battle tank; Pz--Tank.

Knowing about the development of the 105-mm tank gun in the West, the Soviet Union at the end of the 1950's came out with an 115-mm L/50 smooth-bore cannon for the T-62 battle tank. During the middle of the 1960's, there was a strong discussion in the West concerning future battle tank armament (gun or missile system) and some combined weapons were developed (KPz 70; ACRA); the Soviet Union on the other hand rather early decided in favor of high-performance smooth-bore guns. Table 3 shows that, among the battle tanks of the second postwar generation, based on the main armament caliber, only the Chieftain tank had an ammunition effectiveness adequate to handle the T-62.

Looking at the battle tanks of the interim generation, the 152-mm combined weapon was introduced in the West for the M 60 A2 and M 551 "Sheridan"; considering the tank inventory as a whole, these vehicles however only played an insignificant role. As we mentioned in Part 1 of this article, the Soviet Union used the 1970's to introduce a new battle tank model (T-64/72) with a high-performance 125-mm smooth-bore gun. With this armament, the Soviets already during the middle of the 1970's achieved a performance level comparable to the Western battle tanks of the third postwar generation.

The no longer accidental standardization of battle tank main armament systems in Western tanks of the second postwar generation was not achieved during the third postwar generation. In the course of several trilateral comparison firing exercises, the most efficient type for a battle tank of the 1980's was to be determined among the following weapons undergoing development:

The 110-mm air-tube cannon (Great Britain),
The 105-mm air-tube cannon (United States),
The 120-mm smooth-bore cannon (Germany).

It was obviously impossible to achieve decisive agreement during these investigations because the Western battle tanks of the third postwar generation will be equipped with the following weapons:

M-1: 105-mm M-68 air-tube cannon (2,400 vehicles); 120-mm smooth-bore cannon (D) (4,658 vehicles, starting in 1984); Challenger: 120-mm air-tube cannon M 13 A1; AMX 32: 120-mm EFAB smooth-bore cannon; Leopard 2: 120-mm smooth-bore cannon (D).

Because neither the hit performance, nor the terminal ballistic effect of KE and CE ammunition depends on the principle of twist stabilization, France, Japan, and Germany, in addition to the Soviet Union, have now given preference to the smooth-bore gun.

The use of a smooth-bore gun as battle tank main armament is expected to yield the following advantages:

Technically simpler and lower-cost production of barrel;

With the same internal ballistic performance level, the elimination of the rifling grooves and the attendant notching effect will make it possible to design the barrel more favorably in terms of weight;

We get more favorable marginal conditions for surface coating of the barrel's inside;

Because of reduced barrel wear, there is only a minor deterioration in the hit performance as the number of rounds fired is increased.

Looking at the new weapon generation (for example, the 120-mm Rheinmetall smooth-bore cannon), it was possible once again definitely to increase the designed gas pressure by using new technological methods during barrel production (for example, during the initial melting and the remelting processes, during mechanical working and during autofrettage); in the case of the German 120-mm smooth-bore cannon it is 7,000 bar. This alone makes it possible--in spite of a relatively short barrel (L/42)--to attain a muzzle velocity of 1,650 m/sec which is required for KE projectiles. A different route was obviously selected in the case of the main armament for the Soviet T-72 battle tank. Here the high muzzle velocity of the KE round is attained not so much by an above-average high gas pressure but rather by a longer action time of the propellent gases, that is to say, a longer barrel.

Ammunition

In addition to the already outwardly visible increase in the size of the weapon caliber, it was possible over the past 30 years to achieve a definite increase in the effective performance due to the intensive improvement of ammunition and that applies especially to types of ammunition which are suitable for engaging armor.

The hollow-charge ammunition, fired by the German 88-mm tank gun, had a penetration performance of only about 90 mm due to the twist [rifling] stabilization; the United States and the Soviet Union were able to develop hollow-charge projectiles with a penetration performance of about 300-350 mm already for the main armament of the battle tanks of the first postwar generation by switching to fin stabilization (Figure 32). This basic principle was retained in the case of the hollow-charge projectiles for the main armament of the battle tanks of the second and third postwar generations; further increases in penetration performance were achieved primarily by increasing the caliber and by optimizing the hollow-charge warhead (for example, improved homogeneity of the raw material for the filler cone as well as the explosives as such; greater production accuracy (rotation symmetry); and consideration of measures for blast waves guidance. The French 105-mm hollow-charge projectile, called Obus G (Figure 33), represents a certain exception from the development just described. In order, in spite of twist stabilization, not to have to accept any losses in penetration performance, the projectile's interior with the hollow charge rests on ball bearings.

On the whole, it was possible to increase the penetration performance of the hollow-charge projectiles for the battle tanks of the second postwar generation to about 400-450 mm and to more than 500 mm in the vehicles of the third postwar generation.

The anticipated introduction of special armor in enemy armored vehicles will call for considerable development efforts particularly for hollow-charge ammunition. Projectile-forming flat-cone hollow charges or a combination of the usual sharp-point-cone hollow charges, with a flat-cone hollow charge, in the form of a hollow-charge tandem projectile (Figure 34) might possibly in the future assume greater importance.

Looking at the KE projectiles, the performance limit of the full-caliber tank projectile (AP, Figure 35a) had been recognized at the end of World War II. The relatively heavy weight of the projectile, with a predetermined propellent charge quantity, led only to modest muzzle velocities (for example, the AP round for the 90-mm American tank gun with a projectile weight of 10.9 kg and a muzzle velocity of 914 m/sec).

By reducing the weight of the projectile, it was possible, in the case of the hard-core projectile (HVAP, Figure 35b) to achieve a definite increase in the muzzle velocity (for example, HVAP projectile for the 90-mm American tank gun with a projectile weight of 5.6 kg and v_0 of 1,188 m/sec); but the smaller cross-section stress led to an undesirably high velocity drop in flight and thus to a trajectory which was only slightly flat. Only the introduction of the subcaliber projectile (APDS, Figure 35c) made it possible to achieve a more favorable ratio between the internal-ballistic and the external-ballistic cross-section stress. In a full-fledged tank projectile one can figure on a penetration capacity of about 1.5-2 times the caliber; because of the higher energy density at the point of impact and due to the use of heavy-metal alloys as core material, that capacity increased to 2.5-3 times the caliber in the case of the subcaliber propellent-cage projectile.

A further increase in the penetration performance was possible in the case of kinetic-energy projectiles only by increasing the (external ballistic) cross-section stress and thus only due to the lengthening of the flying projectile as such. When we have twist stabilization, the L/d [length-to-thickness] ratio of the projectile is limited to a figure of 5-6; this is why in the end it was also necessary to switch to the principle of fin stabilization for the kinetic-energy projectiles.

As we know, thin-stabilized propellent-cage projectiles (APFSDS) were introduced for the first time in 1961 in the Soviet T-62 battle tank. In the light of lessons learned during the Near East wars, certain inadequacies turned up due to the use of this ammunition; nevertheless, the Soviets were able to assume a leading position with this projectile regarding the penetration performance until the introduction of Western smooth-bore cannons or flechette projectiles.

Interestingly enough, after the introduction of the 115-mm smooth-bore gun on the T-62 battle tank, the West on a broad scale began the development of flechette projectiles so that a broad range of APFSDS projectiles was offered at the end of the 1970's.

The United States: M 735 for the 105-mm air-tube cannon; tungsten core and steel jacket, XM 774 for the 105-mm air-tube cannon; rod-alloy/monobloc;

XM 833 for the 105-mm air-tube cannon; rod alloy, XM 827 for the 120-mm smooth-bore cannon; rod alloy/steel jacket, XM 829 for the 120-mm smooth-bore cannon; rod alloy/monobloc; Great Britain: PPL 64 for the 105-mm air-tube cannon; tungsten, France: Obus Fleche [arrow shell] for the 105-mm air-tube cannon; tungsten/monobloc, Israel, M 11 for the 105-mm air-tube cannon; tungsten/monobloc, Germany: KE projectile for the 120-mm smooth-bore cannon; tungsten/steel jacket.

The complete utilization of the hit accuracy and effect attainable with this projectile principle was to be attained only through considerable efforts in terms of development; the following, among other things, turned out to be problems:

The absorption of the acceleration forces originating during firing (for a short period of time more than 6,000 kN) by the propellent cage;

The transfer of the acceleration forces to the flying projectile;

The heat stress on the tail unit [control surfaces] during flight (at about five times the speed of sound);

The durability of the penetrator during the act of penetration.

It is therefore no wonder that the price tag went up drastically following the introduction of the new ammunition generation. In addition to the development of reasonably priced practice ammunition, the use of firing simulators will therefore gain in importance in the future. Apart from the high ammunition costs, the use of the flechette projectiles in peacetime will be limited by their great range. Under certain marginal conditions, ranges of up to about 30 km can be attained; considering the required safety sectors, these projectiles therefore can be used only in very few exercise areas.

The caliber of the main armament, which kept growing constantly during the period of development considered here, among other things led to a reduction of the ammunition supply that was carried along (Table 4). In the modern, large-caliber tank guns, the assistant gunner finds it difficult to handle the ammunition because of the relatively heavy weight; this applies particularly to actions from movement. To that extent, it would be logical to install an automatic loading mechanism for battle tanks designed for action from movement.

The use of divided ammunition (for example, in the Chieftain battle tank, Figure 36) here represents a certain compromise; the projectile and the propellent charge, to be sure, can be handled very nicely by the assistant gunner but a series of problems must be accepted here (among other things, longer loading times; difficult unloading process; more complicated breechblock mechanism). Another way to reduce the cartridge weight was chosen for the German 120-mm smooth-bore cannon; the use of a partly combustible propellent charge combines the advantages of cartridge ammunition in the design of the breechblock (gas check; ignition process) and at the same time, as in the case of divided ammunition, leads to a small firing gas development in the combat

compartment after the round has been fired; the remaining shell casings only take up relatively little space.

Fire Control System

The fastest progress was made over the past 30 years in the context of structural components technology for battle tanks in the fields of optronics, sensors, fire control computers, and adjustment of aiming motors [drives]. At the end of World War II, the proportion of optronic equipment was about 5 percent of the total price; in a modern battle tank, it already tops the 30-percent mark. An external recognition feature of this development is the increase in optical and electronic observation equipment as well as sensors in the area of the turret of the present-day battle tank; a comparison between Figure 14 (A MX 30 PT) and Figure 21 (AMX 32) makes this statement even clearer. The exposed location and the general vulnerability of the sensors and observation ports at any rate requires that these battle tanks be simultaneously equipped with sturdy and, as much as possible, energy-independent auxiliary observation and aiming devices as well as the corresponding emergency drive types.

The fire-control engineering equipment is designed to enable the tank's crew under combat conditions quickly to engage an appearing target and to hit it reliably. This means that a series of internal-ballistic and external-ballistic factors as well as target data must be acquired and the corresponding correction values (lead, elevation) must be taken into consideration in the aiming process.

In the battle tanks of the first postwar generation, an attempt was made initially on a priority basis through suitable measures to achieve maximum accuracy in firing range determination. The American M-47 battle tank was the first combat vehicle to be equipped with a series-produced optical range finder. The operation and integration of the range finder were not devoid of problems so that other nations did not go that route. The Centurion battle tank had an 12.7 mm fire adjustment MG; before the first round was fired from the main armament, the barrel elevation had to be changed until a hit was scored with the fire adjustment MG. The more uncomplicated training of the gunner provided advantages in this procedure and besides there was a possibility of considering important influencing factors (for example, swing [cant], cross-wind). A disadvantages represented by the lack of accuracy in the process at longer combat ranges and the use of the fire adjustment MG on moving targets; In some cases, firing the fire adjustment MG also from the very beginning betrayed the intention to engage the enemy. The Soviet T-54 battle tank showed up with yet another range finding principle; here, two lines, running diagonally toward each other, became visible in the sights of the tank commander and the gunner; these lines facilitated a so-called stadiametric range measurement process (base line on target). The method was simple but it was not very accurate; obviously however it was enough at least for the employment of the faster projectile type up to main combat range.

The battle tanks of the second postwar generation were overwhelmingly (France, Switzerland, the United States, and Germany) equipped with optical range

finders (Figure 37); in addition to the three-dimensional method, the profile picture principle, which is also better for training purposes, now turned up.

During the early 1960's, the first laser range finder (LEM) was tested; series-produced units however were not installed until starting in 1970 in the battle tanks of the interim generation (M 60 A2, type 74; Merkava). Because of the compact structure of the LEM, it was possible to install this unit in older battle tanks (for example, Chieftain, the "S" battle tank, and the Leopard 1 (Belgium, Australia) and the M 60; Figure 38). It was possible to achieve excellent measurement accuracy ($\pm$10 m) with the LEM used here on a base of rubies and neodymium (provided the target was measured accurately and there were no error echoes); but there were some new problems likewise, for example, the location capability of the active process, multiple echoes, safety for the human eye, etc. It is hoped that a series of these problems can be solved in the future by using so-called CO_2 lasers; because these lasers work in a wavelength range of λ = 10.6 µm, it is easier to penetrate haze and smoke and it will be possible for the first time to check on the laser beam by means of heat-image instruments (λ = 8 - 14 µ).

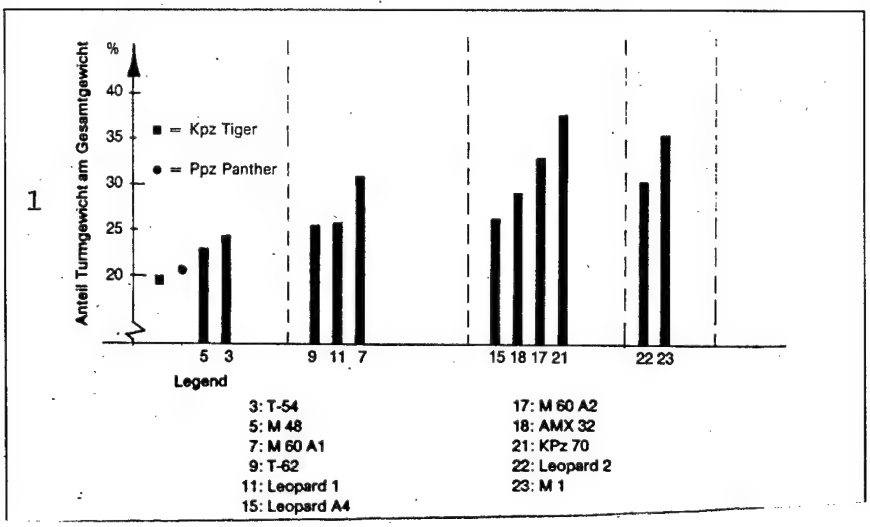
In addition to the various range finding methods, we find various philosophies in the arrangement of the range finder among the postwar battle tanks. The optical range finder in almost all battle tanks of the first and second postwar generations was still designed for operation by the commander (the M-47 was an exception); with the Leopard 1 battle tank, Germany did not adopt this philosophy. Here, the range finder was set up with the gunner so that the commander could devote himself more to battle field observations and to commanding the tank as such. In the battle tanks of the third postwar generation, the range finding job, when an LEM is used, can be accomplished by both crew members.

To determine the ammunition-dependent and range-dependent elevation angle, simple mechanical computers with curve disks were used in some battle tanks of the first postwar generation (M-48, Centurion). The gunner's activities in the M-48 tank were greatly facilitated by the so-called sight angle converter which, during range finding, automatically transferred the particular elevation angle to the weapon while the graduated range mounts remained on the target. In the battle tanks of the second postwar generation, electronic tank computers were being tested (for example, in the case of Leopard 1) but they were obviously not yet ready for general use. It was possible to introduce so-called hybrid computers (analog-digital computers) for ready use only in the battle tanks of the interim generation (for example, Leopard A4, type 74). This means that it was then possible for the first time considerably to increase the volume of input data (partly by using diverse sensors). Table 5 presents an overview of the factors processed by an electronic tank computer. The use of pure digital tank computers seems indicated for the future; this type of computer can be used more flexibly and can handle a larger number of functions although its structural volume is smaller (for example, replacement for the operating type logic and use for internal testing purposes, for navigation, and in the context of weapons stabilization). The M-1 and Merkava are already equipped with digital computers today.

Table 5. Parameters for Elevation Angle and Lead Determination which in Some Battle Tanks Equipped with Electronic Tank Computers (Vehicles of the Interim Generation as well as the Third Postwar Generation) are Taken into Consideration to Improve the First-Round Hit Probability

Parameter	Determination by Means of	Input into computer
Combat range	Range finder	Analog or digital
Type of ammunition	Manual	
Angle of jump		Manual
Lead	Computer	
Cross-wind	Cross-wind sensor	Analog
Barrel bend	Field adjustment system	Manual
Cant	Cant sensor	Analog
Powder temperature	Powder temperature sensor	Analog
Parallax error	Computer	
Barrel wear		Manual
Air values	Air value sensor	Analog
Pressure		
Temperature		

Table 6. Share of Turret Weight out of Total Weight of Some Battle Tanks, 1950-1980



Key: 1--Share of turret weight out of total weight; Ppz--Engineer tank [?].

Weapon Aiming and Stabilization System (WRSA)

The gyro firing instrument installed in the "Sherman" battle tank did not prove effective; this is why no stabilization was provided in the M-47 and M-48 battle tanks. An electrohydraulic aiming system, made by Cadillac-Gage, was used in both battle tanks. In Great Britain, preference was given to

the purely electrical aiming motor (with rotating metadyne transformers) from the start of postwar development on; the Centurion was one of the first battle tanks to get a two-axis stabilization system. The Soviet T-54 battle tank was equipped in 1955 with vertical stabilization as a subsequently installed accessory; the T-55 appeared in 1957, likewise with two-axis stabilization. Interestingly enough, an electric drive was provided for the traversing axis in both of these battle tanks and a hydraulic aiming drive was provided for the elevation axis.

As we can see in Table 6, an above-average increase in the turret weight is superposed on the general increase in the battle tank vehicle rate. In the battle tanks of the first postwar generation, the share of the turret weight out of the total weight was about 24 percent; over the past 30 years it partly went up to 36 percent. Heavier turret weights and especially heavier inertial moments with relation to the high axis necessarily called for more powerful aiming motors and that meant that the weight of these structural components also went up along with the structural volume and the heat loss given off; the definitely higher energy requirement led to a considerable extra load on the power system in the tank. This is why the search for new possibilities of energy supply from WSRA (weapon aiming and stabilization system) is quite understandable; a rather noteworthy method was used in the 70 and M-1 battle tanks by means of direct, that is to say, mechanical connection of the water pump to the main engine; two energy conversions, which caused losses, were eliminated and at the same time the [electric] power grid in the tank was relieved of the energy need of the WRSA (Figure 39). Of course, in this solution, it is necessary to use a hydraulic collecting ring which represents a not very reliable component that however requires little care.

It remains to be seen whether the electro-hydraulic or mechanical-hydraulic drive forms will be able to assert themselves in the future since hazards springing from the hydraulic fluid became particularly clear in the M-60 battle tank during the Yom Kippur War. The placement of hydraulic energy supply for the WRSA [as published] separately from the fighting compartment can be considered a compromise or an interim solution; this solution is today used in the Leopard 2 and Merkava battle tanks.

In the future, electric aiming motors may well come into increased use since the development process has led us via rotating transformers (metadyne) and static rectifiers (thyristors) to the relatively sturdy transistor-equipped high-capacity electronics. Here are some of the advantages expected from electric aiming motors, among others:

Lesser complexity, greater reliability;

Less care and maintenance;

Less structural volume and lighter weight (depending on the stabilization quality);

No hazard from hydraulic fluid.

In the battle tanks of the second postwar generation, the two-axis stabilization system was used in almost all vehicles and they revealed primary stabilized main armament and tracking sights (mechanical connection between weapon and sight) (Figure 40a). Because of the heavy masses and weights to be stabilized, the stabilization quality here was relatively poor so that weapon stabilization was used primarily to observe the battlefield from the move, to identify targets, and to reduce the time during which it was necessary to hold fire.

In the battle tanks of the third postwar generation, the sights in the overwhelming number of cases were stabilized in a primary fashion and the main armament was made to follow via a so-called synchrochain; the mechanical connection here was replaced with an electrical one (Figure 40b). An exception here is the auxiliary telescope which is used for emergency operation. The release of the firing pulse takes place in the modern stabilization systems only when the main armament--considering the necessary correction values for elevation and lead--is within a so-called "coincidence window" around the line of sight. By means of this principle, the stabilization quality of the main armament no longer influences the high result but, if at all, only the coincidence frequency.

The mechanical disconnection of the main armament from the controlling sights is also a prerequisite for making sure that the weapon, after firing (automatically), will be able to run into a loading index position without the gunner losing the target from his sights. Moving the main armament into a loading index position is necessary when we use automatic loading mechanisms (see for instance the 70 and T-72 battle tanks) but it can also be used to simplify the loading process for the assistant gunner (for example in the T-62 and the Leopard 2).

Some test vehicles with a three-axis stabilized turret (Figure 41) did provide evidence that this idea is feasible but also revealed the considerable technical effort required. In the case of the modern WRSA, the use of vertical sensors proved to be a low-cost alternative. When we use plumb line circles in place of oil-damped pendulums, we can take into consideration not only a possibly existing cant in the static case but we can also perform a so-called dynamic roll correction in combat from movement.

Aiming and Observation Equipment

It was realized relatively early in the United States that redundancy between the commander and the gunner in conducting the fire fight leads to a faster response capability in engaging suddenly appearing targets and in engaging multiple targets. This is why it was possible in the M-47 and M-48 tanks not only for the gunner but also for the commander autonomously to direct the fire fight whereas in the other vehicles of the first postwar generation (Centurion, T-54) the commander was unable independently to use the main armament.

In the battle tanks of the second postwar generation, it was primarily the equipment of the commander with sights that was improved. In particular, the commander was given the possibility of performing all-around observation

with magnifying sights. In this process, two basic solution possibilities emerged: the "cupola system" (France, the United States, the Soviet Union, Great Britain) and the "periscope system" (Israel, Germany); the basic differences between these two systems are shown in Figure 42. The commander's all-around periscope was stabilized in a primary fashion already in a series of vehicles of the interim generation.

Optimized operational functions, the use of laser range finders and efficient aiming motors contributed to a considerable reduction in the so-called technical response time (Figure 43); this resulted in an unbalanced ratio to the so-called tactical response time. In the future the use of electronic observation equipment (for example, heat image instruments) might possibly result in a definite reduction in the discovery times.

The battle tanks of the first postwar generation were not yet able independently to conduct night-time combat operations; battlefield illumination by means of pyrotechnical devices was necessary here. In some battle tanks, only the driver was equipped with IR image converter instruments (M-47; M-48). Starting in 1955, the Soviet T-54 tank was for the first time provided with complete IR equipment (including among other things the IR sight for the gunner and the IR firing search light).

In the battle tanks of the second postwar generation, fire-control equipment for independent night-time combat operations finally prevailed; the active IR technique was used in almost all battle tanks; here the reflected radiation of an object (λ = 0.7 to 1.2 μ) is picked up. For this purpose, IR firing search lights with an output of 200 w (T-62) to 3,000 w (Chieftain) as well as IR telescopic sights with image converter tubes were used. Using these instruments, it was possible to conduct night-time combat operations--depending upon the weather--at ranges of up to 1,000 m (Figure 44).

An essential disadvantage of the IR night vision equipment consisted in the fact that IR source was capable of being located (firing search light) by means of enemy image converter instruments. Efforts in the development of passively working night vision instruments first led to the so-called residual light amplifiers. Such instruments were installed subsequently on some battle tanks of the interim generation (M 60 S2; AMX 32) and other vehicles of the first generation (for example, Leopard 1; Figure 45). The advantages of this instrument technology reside in the good geometric resolution and the relatively small volume, weight, and cost expenditure. Of course, the capacity of residual light amplifiers depends on the surrounding light in the environment as well as the contrast and reflex behavior of the target; the strong influence from meteorological marginal conditions also proved to be a disadvantage.

The military use of heat image instruments emerged as an alternate development in the United States during the early 1970's. These instruments work in the wavelength range of "distant IR" (λ = 8 to 14 μm) and they detect the inherent radiation of the object in the process (Figure 46). The properties of the heat image instruments--independence of environmental light, greater target contrast in the case of military objects, good atmospheric penetration capability also in case of haze, fog, and smoke, etc.--clearly bring out

the suitability of these devices as military observation equipment at night and during poor visibility. Of course, in the beginning, the high cost and the complicated production methods for the subassemblies put a damper on the prevailing high hopes. Larger-scale procurement was started only in 1976 when the standardization of the most important subassemblies in the United States to form the so-called "common modules" was accomplished successfully so that the prerequisites were created for economical large-series production.

Figure 47 shows a circuit diagram for a heat image instrument. Cooling the HgDcTe detector arrays to a temperature of 77° Kelvin (≙ - 196° C) is necessary to keep the instrument functioning properly.

The use of heat image instruments in the battle tanks of the third postwar generation presently assures the Western missions of a clear combat value advantage over the vehicles of the Warsaw Pact forces when it comes to night fighting and combat in poor visibility; the heavy cost and the unconventional technology therefore are justified.

The customary camouflage measures reduce the discovery, recognition, and identification possibilities in the visible range and compared to observation using residual light amplifiers; but they are ineffective against observation using heat image instruments. With the help of heat image instruments it is likewise possible in most cases to penetrate the military camouflage smoke-screens used so far. If heat image technology does prevail during the 1980's also among the Warsaw Pact countries, this would produce lasting consequences in terms of the design of future armored vehicles.

In the battle tanks of the second postwar generation, the sights for daytime vision were exchanged against IR telescopes in the establishment of close-range combat readiness; this method was no longer suitable when it came to the introduction of residual light amplifiers or the heat image instruments partly because of the size of these instruments. Looking at the passively working night vision instruments, we now have the possibilities of either integrating the night-vision component into the current day time systems or using it as an independent instrument; this so-called two-sensor or three-censor concept is illustrated in the form of a diagram in Figure 48. As a compromise between integration expenditure and capacity, the heat image instrument in the Leopard 2 and M-1 tanks is integrated within the main sight used by the gunner and the commander can observe the heat image by means of a so-called light-pipe or monitors.

Summarizing, we can say that the technical implementation of the following military requirements has led to the initial mentioned high cost share for fire control components in the battle tanks of the third postwar generation:

High first-round hit probability at combat ranges of up to 2,000 m when firing on stationary and moving targets;

Accurate round fired from movement;

Equivalent daytime and night-time combat capability (to be continued).

FIGURE CAPTIONS

Figure 32. Fin-stabilized hollow-charge projectile with slipping guide band.

Figure 33. Twist-jacket-stabilized hollow-charged projectile for the 105-mm DEFA tank gun in the AMX-30. Key: (1) Piezoelectric contact; (2) Ballistic hood; (3) Control cone; (4) Projectile casing; (5) Lining; (6) Explosive; (7) Projectile body; (8) Projectile bottom with fuse; (9) Tracer casing.

Figure 34. Basic structure of a tandem hollow-charge projectile head with a flat cone and a pointed cone hollow charge.

Figure 35. Development of KE projectile: (a) Full-scale AP round; (b) Hard-core projectile (HVAP); (c) Propellent cage projectile (APDS); (d) Flechette projectile (APFSDS).

Figure 36. Divided ammunition for the Chieftain battle tank. Reading from left to right: HESH projectile, propellent charge for HESH, WP [Warsaw Pact] projectile, propellent charge for APDS, APDS projectile; below, cartridges for the 12.7 mm fire adjustment MG, a propellent charge igniter for the main armament and 7.62 mm MG ammunition.

Figure 37. Fire control equipment for the M-60 battle tank; the optical range finder is operated by the commander.

Figure 38. View of the sights in an M-60 battle tank with improved combat value (in this case, the M-60 A3) with laser range finder and heat image instrument.

Figure 39. Circuit diagram for energy supply and number of necessary energy conversions for various aiming systems in battle tanks. Key: 1--Electro-hydraulic aiming motor (Leopard, M-60, etc.), number of energy conversions: 4; 2--Main motor; 3--Mechanical; 4--Electrical; 5--Hydraulic-mechanical aiming drive (70, M-1 battle tanks), number of energy conversions: 2; 6--hydro-mechanical aiming motor (KPz 70 , M-1), energy conversion reading: 2; 7--Connections; 8--Electro-mechanical aiming drive (Centurion, Chieftain), number of energy conversions: 2.

Figure 40. Circuit diagram showing fire control systems with primary stabilized main armament (battle tanks of second postwar generation) and primary stabilized sights (battle tanks of third postwar generation). Key: 1--Main sight; 2--Line of sight; 3--Mechanical connection; 4--Range; 5--Ammunition; 6--Sensors; 7--Manual inputs; 8--Fire control computer; 9--Firing; 10--Operating type logic; 11--Connections; 12--Mechanical; 13--Hydraulic; 14--Electrical; 15--Electric synchrochains; 16—Commander; 17—Gunner; 18--Assistant gunner; 19--Fire control system with primary stabilized main armament; 20--Synchrochain; 21--WNA [expansion unknown] electronics; 22--Central logic; 23--Fire control system with primary stabilized sights and following main armament; K--Coincidence surveillance; RG--Aiming instrument (?).

Figure 41. Experimental vehicle with three-axis stabilized turret; the 105-mm tank gun was rigidly integrated into the turret housing. The focus shows the vehicle with the turret position at 7 o'clock.

Figure 42. Circuit diagram showing sight systems for tank commanders. On the left, the "periscope system" with fixed periscope crown and single eyepiece all-around periscope; on the right, so-called "cupola system" with rotating commander's cupola and integrated periscopes as well as binocular sights.

Figure 43. Time frame of enemy target engagement process with illustration of tactical and technical response time. Key: 1--Tactical response time (discovery time); 2--Technical response time; 3--Appearance of target; 4--Discovery, 5--Recognition; 6--Identification; 7--Shot fired; 8--Decision to engage; 9--Target allocation; 10—Range measurement; 11--Data processing; 12--Fine adjustment.

Figure 44. Employment of actively working IR white-light firing search light during night action by a platoon of Leopard 1 battle tanks.

Figure 45. Leopard A3 battle tank, converted for use with passively working night vision instrument. The PZB 200 illustrated works on the basis of the residual light amplifier principle (LLLTV).

Figure 46. Image of T-54 battle tank seen through heat image instrument. The gun, the firing search light, and the engine compartment reveal particularly intensive inherent heat radiation in this vehicle.

Figure 47. Circuit diagram showing heat image instrument with possibility of direct observation of LED image (OMUX principle). Key: 1--Afocal accessory; 2--IR; 3--Direction of observation; 4--Scanning mirror; 5--Visible; 6--IR objective; 7--Eye; 8--Light diodes; 9--Collimator; 10--Detector Dewar; 11--Preamplifier; 12--Main amplifier; 13--Fan.

Figure 48. Circuit diagram showing arrangement possibilities of daytime and night-time vision instruments in battle tanks using passive night vision equipment. Key: 1--Two-sensor concept with combined daytime and night-time vision instruments for use by gunner; 2--Commander's vision instrument [screen]; 3--Gunner's screen; 4--Daytime channel; 5--Night-time channel; 6--Two-sensor concept with combined daytime and night-time screen for commander and gunner; 7--Three-sensor concept with separate night-time screen; HZF [expansion unknown].

5058
CSO: 1826/34

GERMAN SOURCE ON LONG-TRACK RADAR

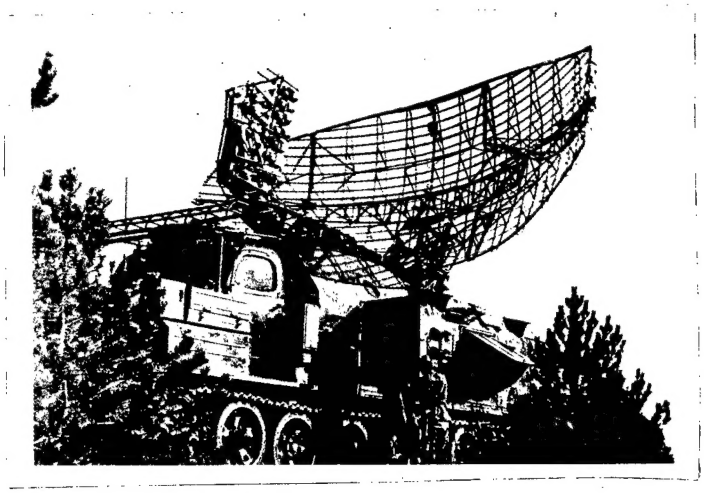
Frankfurt/Main SOLDAT UND TECHNIK in German No 3, Mar 82 p 139

[Text] Early Warning and Target Search Radars of Warsaw Pact AA Defense Force

The Soviet AA radar unit, introduced under the NATO code name LONG TRACK, is being used by the AA missile units of the WP [Warsaw Pact] ground forces early warning and target search radar. It is furthermore used as target allocation radar for fighters. The radar unit, which has been in service since 1968 and which has since then been modernized several times, is carried on a tracked prime mover. It resembles the heavy artillery prime mover model AT-T but is longer than the latter (seven instead of five bogies) and it is provided with an armored superstructure which can hold instruments and the crew. The radar antenna, which can be swung around by 360°, is on the body. It is about 9 m wide and 3 m high. On the move, it can be folded down. The radar unit, which works in the I-band, has a horizontal range of more than 150 km and a vertical range of more than 30,000 m.

LONG TRACK is used as early warning and target search radar for the SA-4/GANEF AA guided missile system of the AA rocket brigades of the WP armies and for the SA-6/GAINFUL AA guided missile system of the AA regiments of the WP divisions. As a rule, each AA rocket battalion has one LONG TRACK radar unit. Because both the missile carrier and the firing mechanisms of both weapons systems and the pertinent fire control radar units (STRAIGHT FLUSH for the SA-6 and PAT HAND for the SA-4) are mobile on tracked vehicles, both weapons systems have a full cross-country capability.

LONG TRACK was delivered by the Soviet Union also to Yugoslavia and to its Arab arms customers in North Africa and the Near East. The photo shows a LONG TRACK AA radar unit of the Yugoslav People's Army.



LONG TRACK AA radar.

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